

APPENDIX B

US 6,584,443

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- Title: Apparatus and method for audio data/audio-related information transfer



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Kawamura et al.

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(54) **APPARATUS AND METHOD FOR AUDIO DATA/AUDIO-RELATED INFORMATION TRANSFER**

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(52) U.S. Cl. **704/500**; 704/501; 704/502;
704/503; 704/504

(58) Field of Search 704/200, 500,
704/501, 502, 503, 504; 375/240

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,228,059 A 7/1993 Takegahara et al. 375/17
6,175,592 B1 * 1/2001 Kim et al. 375/240

FOREIGN PATENT DOCUMENTS

CN 1084306 3/1994
CN 1205502 1/1999
JP 11331218 11/1999

OTHER PUBLICATIONS

"Digital Audio Interface" from the International Standard, CEI IEC 958, First Edition 1989-03.

* cited by examiner

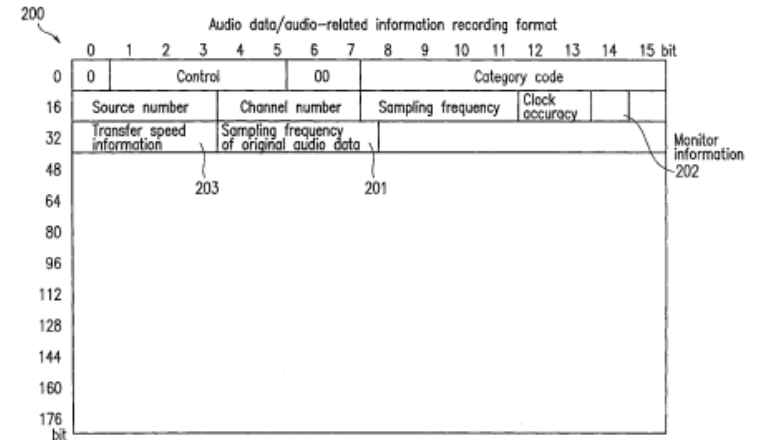
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(57) **ABSTRACT**

A method for transferring audio data and audio-related information includes generating second audio data from first audio data, transmitting second audio data and audio-related information associated with the second audio data, and receiving the second audio data and audio-related information which includes information on a sampling frequency of the first audio data.

27 Claims, 6 Drawing Sheets



Claim 7	VESA Embedded DisplayPort Standard v1.3/VESA DisplayPort Standard v1.2
7. A method for transferring audio data and audio-related information , comprising:	<p data-bbox="537 247 1261 279">2.2 eDP Support by Source and Sink Components</p> <p data-bbox="606 289 1760 411">Except where otherwise described in this document, <u>an eDP Source and Sink device must be fully compatible with the DisplayPort 1.2 Standard</u>. Typically only one or two Main Link lanes will be needed due to the limited panel resolution normal for embedded application. The eDP Sink device must support Fast Link Training, and support of Fast Link Training by the Source device is an implementation option.</p> <p data-bbox="994 444 1309 472"><VESA eDP Std v1.3></p> <p data-bbox="537 522 942 555">2.2.5.3 <u>Audio Stream Packet</u></p> <p data-bbox="537 565 1798 658">Transport of an audio stream is optional. When an audio stream is transported, the Audio InfoFrame packet describing the attribute of the audio stream and Audio_TimeStamp packet must be also transported, each once per frame during the vertical blanking period of the main video stream.</p> <p data-bbox="537 676 1773 833">Audio_Stream packets must be sent during both horizontal and vertical blanking periods of the main video stream. During the horizontal and vertical blanking period, DisplayPort Source device must transmit an Audio_Stream Packet whenever it has enough data to form a packet and access to the Main Link to transmit the packet(s). For more information about audio transport over DisplayPort, refer to Section 2.2.5.3 and Section 6.</p> <p data-bbox="537 861 1093 893">2.2.1.3 Main Video Stream Data Packing</p> <p data-bbox="537 903 1590 932">The link layer must first steer pixel data in a pixel-within-lane manner as shown in Table 2-2.</p> <ul data-bbox="575 961 1750 1258" style="list-style-type: none"><li data-bbox="575 961 1750 989">• <u>VB-ID</u> must carry the following information:<ul data-bbox="620 1008 1750 1258" style="list-style-type: none"><li data-bbox="620 1008 1750 1036">○ Whether the main video stream is in the vertical display period or the vertical blanking period.<li data-bbox="620 1055 1750 1083">○ Whether the main video stream is in the odd field or the even field for interlaced video<li data-bbox="620 1102 1750 1130">○ Whether the main video stream is interlaced or non-interlaced (progressive)<li data-bbox="620 1149 1750 1206">○ Whether the BS is inserted while no video stream is being transported. The symbols transmitted over the Main Link when no video stream is active are shown in Table 2-3.<li data-bbox="620 1225 1750 1258">○ <u>Whether to mute the audio</u> <p data-bbox="1012 1272 1309 1300"><VESA DP Std v1.2></p>

Claim 7	VESA DisplayPort Standard v1.2				
<p>a transmission step of transmitting the audio data and audio-related information associated with the audio data; and</p> <p>a reception step of receiving the audio data and the audio-related information,</p>	<p>2.2.5.3 Audio Stream Packet</p> <p>Transport of an audio stream is optional. When an audio stream is transported, the Audio InfoFrame packet describing the attribute of the audio stream and Audio_TimeStamp packet must be also transported, each once per frame during the vertical blanking period of the main video stream.</p> <p>Audio_Stream packets must be sent during both horizontal and vertical blanking periods of the main video stream. During the horizontal and vertical blanking period, DisplayPort Source device must transmit an Audio_Stream Packet whenever it has enough data to form a packet and access to the Main Link to transmit the packet(s). For more information about audio transport over DisplayPort, refer to Section 2.2.5.3 and Section 6.</p> <p style="text-align: center;">Table 2-51: Header Bytes of Audio_Stream Packet</p> <table border="1" data-bbox="550 602 1725 749"><thead><tr><th>Byte#</th><th>Content</th></tr></thead><tbody><tr><td>HB0</td><td>Secondary-data Packet ID InfoFrame packet, <u>Audio_TimeStamp packet</u>, Audio_Stream packet, Audio_CopyManagement packet, and ISRC packet must have the same Packet ID when they are associated with the same audio stream.</td></tr></tbody></table> <p>2.2.1.3 Main Video Stream Data Packing</p> <p>The link layer must first steer pixel data in a pixel-within-lane manner as shown in Table 2-2.</p> <ul style="list-style-type: none">• <u>VB-ID</u> must carry the following information:<ul style="list-style-type: none">○ Whether the main video stream is in the vertical display period or the vertical blanking period.○ Whether the main video stream is in the odd field or the even field for interlaced video○ Whether the main video stream is interlaced or non-interlaced (progressive)○ Whether the BS is inserted while no video stream is being transported. The symbols transmitted over the Main Link when no video stream is active are shown in Table 2-3.○ <u>Whether to mute the audio</u>	Byte#	Content	HB0	Secondary-data Packet ID InfoFrame packet, <u>Audio_TimeStamp packet</u> , Audio_Stream packet, Audio_CopyManagement packet, and ISRC packet must have the same Packet ID when they are associated with the same audio stream.
Byte#	Content				
HB0	Secondary-data Packet ID InfoFrame packet, <u>Audio_TimeStamp packet</u> , Audio_Stream packet, Audio_CopyManagement packet, and ISRC packet must have the same Packet ID when they are associated with the same audio stream.				

Claim 7

a transmission step of transmitting the audio data and audio-related information associated with the audio data; and

a reception step of receiving the audio data and the audio-related information,

VESA DisplayPort Standard v1.2**2.2.1.5 Main Stream Attribute/Secondary-Data Packet Insertion**

The dummy stuffing data symbols during the video blanking periods (both vertical and horizontal) may be substituted either with main stream attributes data or a secondary-data packet. Both must be framed with SS and SE control symbols as shown in Figure 2-14.

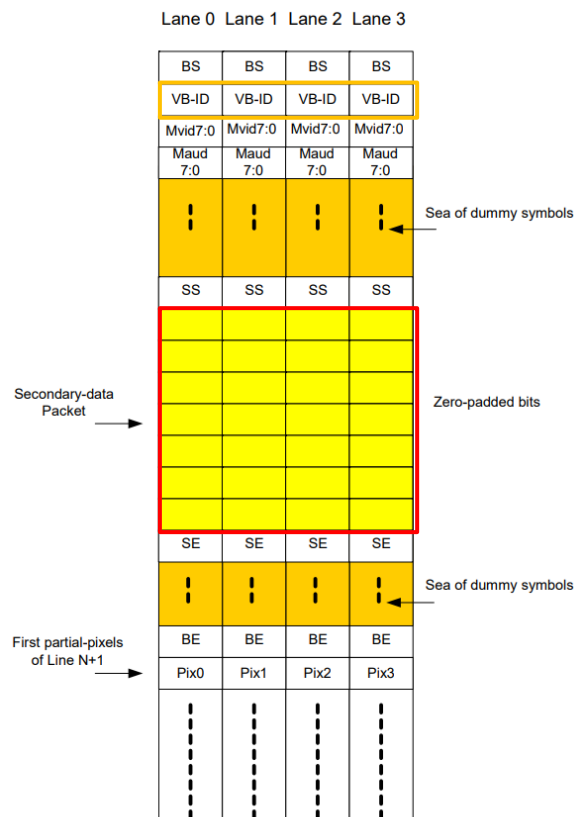


Figure 2-14: Secondary-Data Insertion

Claim 7

wherein the audio-related information includes monitor information indicating whether or not the audio data is capable of being monitored in the reception step.

VESA DisplayPort Standard v1.2

2.2.1.3 Main Video Stream Data Packing

The link layer must first steer pixel data in a pixel-within-lane manner as shown in Table 2-2.

- VB-ID must carry the following information:
 - Whether the main video stream is in the vertical display period or the vertical blanking period.
 - Whether the main video stream is in the odd field or the even field for interlaced video
 - Whether the main video stream is interlaced or non-interlaced (progressive)
 - Whether the BS is inserted while no video stream is being transported. The symbols transmitted over the Main Link when no video stream is active are shown in Table 2-3.
 - Whether to mute the audio

Table 2-3: VB-ID Bit Definition

VB-ID Bit	Bit Name	Bit Definition
Bit 0	VerticalBlanking_Flag	This bit must be set to 1 at the end of the last active line of a video frame and stay 1 during the vertical blanking period. A Source device may clear this bit in the VB-ID either immediately prior to the first active line of a video frame (that is, the first BE of a video frame) or immediately after the first active line (that is, the first BS ending the first active line of a video frame). A Sink device must be able to handle either case. This bit is also set to 1 when there is no video stream (as indicated by bit 3 set to 1).
Bit 1	FieldID_Flag	This bit must be set to: 0 right after the last active line in the top field. 1 right after the last active line of the bottom field Refer to 2.2.4.2 for definitions of the top and bottom fields. For progressive (non-interlaced) video there is no bottom video and this bit remains 0.
Bit 2	Interlace_Flag	This bit must be set to 1 when the main stream is an interlaced video. For non-interlaced video or no video, this bit must stay 0.
Bit 3	NoVideoStream_Flag	This bit must be set to 1 when preceding BS is inserted while no video stream is transported. When this bit = 1, the Mvid 7:0 value must be "don't care." Note: An audio stream may be transported even when no main video stream is being transported.
Bit 4	<u>AudioMute_Flag</u>	<u>This bit must be set to 1 when the audio is to be muted.</u>
Bit 5	HDCP SYNC DETECT	Used by HDCP capable DisplayPort uPacket RXs to detect the CP lock status. Refer to HDCP Specification 1.3 – Amendment for DisplayPort
Bits 7:6	RESERVED	RESERVED (All 0s)

Claim 9	VESA DisplayPort Standard v1.2
<p>9. A method according to claim 7, further comprising a muting step of muting the audio data if the monitor information indicates that the audio data is not capable of being monitored in the reception step.</p>	<p>5.2.3.2 Audio Stream Format/Timing Change</p> <p>As for audio format/timing change, the Source device should set and keep <u>VB-ID bit 4 (AudioMute_Flag)</u> to a '1' until after the new Audio InfoFrame and Audio_TimeStamp have been sent. An audio format change is caused by any of:</p> <ul style="list-style-type: none">• A change between the compressed and non-compressed audio• A change in the sampling rate• A change in the number of channels <p>Those packets may be sent as soon as the next frame boundary (when the main video stream is present) or after the next 512th BS symbol set (when the main video stream is absent).</p> <p><u>The Sink device must mute the audio when the AudioMute_Flag is set</u>, and should be ready to receive a new audio format upon detecting the change in Audio InfoFrame and Audio_TimeStamp packets.</p>

Claim 9	VESA DisplayPort Standard v1.2
<p>9. A method according to claim 7, further comprising a muting step of muting the audio data if the monitor information indicates that the audio data is not capable of being monitored in the reception step.</p>	<p>6.3.1 Handling of an Audio Format Change</p> <p>The transported audio format may be changed at the any time. The DP transmitter should start sending an audio mute signal prior to the audio format change, by <u>setting bit 4 (AudioMute_Flag) of VB-ID which is sent once per main video stream line period (or once per 8192 link symbols when the main video stream is absent).</u> An audio format change is caused by any of:</p> <ul style="list-style-type: none">• A change between the compressed and non-compressed audio• A change in the sampling rate• A change in the number of channels <p>This signal indicates to the DP receiver that the audio system is in a transient process and the audio stream may be not valid at this time. <u>When the AudioMute_Flag is ‘1’, a DP receiver must disable its audio output while continuing to receive and process Audio Time-stamps.</u></p> <p>The DP transmitter should clear the AudioMute_Flag to ‘0’ only after finishing the transient process at the audio source input, finishing audio clock measurement with a correct and stable value and providing information about this change to the receiver. The DP transmitter should clear the audio mute signal only after transferring Audio Time-stamp and Audio Info packet (if needed).</p> <p>Once the DP transmitter clears the AudioMute_Flag to ‘0’, a DP receiver should enable its audio output only after the regenerated audio clock becomes stable and after it has collected enough audio status information.</p>